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(54) Nappy Liner

(57) A flexible, porous nonwoven fabric layer or sheet to be worn against the skin of a person and serving as a carrier for one or more water repellent materials which migrate from the fabric to the skin when worn thereagainst, to a sufficient extent to impart a degree of water repellency to the skin.

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## SPECIFICATION

## Fabric for wear between an absorbent article and the skin

5 The invention relates to a fabric for wear between an absorbent article and the skin and particularly to garments, especially nether garments, and to compositions carried therein. 5

Disposable nappy liners, fabricated from nonwoven fabrics, are well-known. The usefulness of these nappy liners is that they retain most, if not all, of an infant's faeces, thus rendering the laundering of the associated nappy, usually a terry towelling nappy, a less disagreeable task than would otherwise be the case. The unit cost of these nappy liners is low enough to admit of a single use prior to disposal. 10

The nonwoven fabric in such nappy liners is itself generally made of viscose rayon fibres, which are hydrophilic, but the liner may be rendered water repellent by bonding the fibres with a water repellent binder composition. Such nappy liners, by virtue of their water repellency and porosity, allow ready passage of urine therethrough for absorption by the associated hydrophilic nappy and have less tendency to retain urine than a corresponding fabric made from hydrophilic fibres such as rayon or cotton. Thus the water repellent liner presents a relatively dry surface to the infant's skin, keeps the infant's skin drier than would otherwise be the case, and effectively creates a finite barrier to urine between the baby's skin and the absorbent nappy. 15

It is believed that by keeping the infant's skin relatively free from urine, the chances are diminished that the skin will become so softened that it becomes unduly abradable or becomes host to micro-organisms, both of which effects promote areas of redness and soreness. 20

Thus whereas the original nappy liners provided a benefit to the mother in facilitating disposal of faecal matter, but no direct benefit to the baby, the water-repellent nappy liners provide a benefit also to the baby by helping to reduce the incidence of nappy rash, excessive hydration of the skin being a prime predispositional factor in causing nappy rash. 25

However, the protection afforded by known liners leaves room for improvement, in that if pressure such as that due to the weight of the baby, is applied to a saturated or very wet nappy, urine may be forced back through the porous liner and thus contact the skin. 30

It is well known that the application of water-repellent materials to the appropriate skin area is effective in helping to prevent the onset of nappy rash by reducing direct contact of urine with the skin and thus reducing skin hydration. Products typically used for this purpose for many years include zinc and castor oil compositions and petroleum jelly. 35

It is an object of the invention to combine in one product the benefits of the nappy liner, the water repellent liner, and the application of a water barrier to the skin. These benefits are to be obtainable not only with a nappy liner as such, but also with a lining or facing forming an actual part of a disposable nappy or of a garment such as a diaper. It is a further object to provide a product affording protection against excessive skin hydration in incontinent adults. 40

Accordingly in a broad sense the invention provides a nonwoven fabric serving as a carrier for one or more water repellent materials which migrate upon use, from the fabric to the skin, to a sufficient extent to impart a degree of water repellency to the skin. 45

According to one aspect of the present invention we provide a composition for use in rendering human skin water-repellent comprising a water-repellent oil carried on the fibres of a flexible, porous nonwoven fabric in an amount effective to impart water-repellency by migratory transfer of a proportion of the oil to skin against which the fabric is worn as a liner or facing for a nappy or garment. 50

In what follows, we refer to the water-repellent oil as the oily impregnant. The oily impregnant may be a liquid medicinal white oil, a silicone oil, an isopropyl fatty acid ester or a solution of a paraffinic ester in liquid medicinal white oil. By medicinal white oil we mean a white refined petroleum oil or liquid petrolatum of medicinal or cosmetic quality. 55

In preferred embodiments of the invention the nonwoven fabric is itself water-repellent, inherently by the use of hydrophobic fibres or as the result of the treatment of hydrophilic fibres. The fabric may, however, be water-repellent solely on account of the oily impregnant. 60

The invention is particularly advantageously embodied in the form of nappy liners whereby the disposal of faecal matter is made easier. The invention extends, however, to articles, especially absorbent articles intended to be worn next to the skin as garments or otherwise, which are lined or faced with the treated nonwoven fabric. 65

By disposable we mean that the product is expected to be thrown away after a single use and is suited to normal methods of disposal of excrementally soiled disposable articles of generally similar form. 70

The products of the invention are inherently porous, i.e., permeable to moisture, whether or not they are actually perforated as by bundling or re-arranging the fibres during formation of the nonwoven fabric or by needling the formed fabric. The inherent porosity of nonwoven fabrics in general is adequate and effective both for the migratory transfer of the oily impregnant to the skin and for the conduction of urine away from the skin, when the product of the invention is 75

being worn.

The nonwoven fabric is in the form of a bonded layer or sheet which may be separate or form an integral part of an absorbent article and may be of single ply or multi-ply construction, and plain or shaped to fit an absorbent article on the wearer. Typically as a nappy liner it will be a generally rectangular piece of separate fabric.

The unbonded web of fibres constituting the precursor web of the bonded nonwoven fabric may be wet-laid, but preferably it is dry-laid. Preferably the web is a carded web, although it may, for example be air-laid using a "Rando-Webber" random air-laying machine (produced by the Rando Machine Corporation). Natural and/or man-made fibres may be employed in the web, which may comprise one or more than one ply. Preferably the web comprises cellulosic fibres, preferably viscose rayon fibres, although polyester, cotton fibres and polypropylene fibres may be used. Combinations of fibres, e.g. polypropylene and viscose and blends of two or more combinations, may be used. Fibres having a length of 20 to 50 mm and a denier of 1.5 to 3.0 are preferably used.

Before being bonded, the laid web may be rearranged or "bundled", as by fluid streams, preferably in accordance with the process described in any of Specifications Nos. 816,673 836,396 and 836,397. Bundled nonwoven fabrics have greater dry and in-use integrity than non-bundled nonwoven fabrics. The binder composition may be applied to the unbonded web by, for example, a rotogravure print roller. Reference is also made to Fig. 5 of Specification No. 742,089 for suitable apparatus for carrying out the bonding step. The web may then be dried and wound up into a roll ready for impregnation.

The binders used in the binder composition should be such that they do not give rise to harshness and rigidity in the nonwoven fabric so that dry abrasion is minimised. Advantageously a water-repellent binder composition is used whereby the bonded fibres are rendered less wettable by water. Suitable binders include self-cross-linking polyacrylates, vinyl acetate/acrylic ester copolymers with self-cross-linking properties, externally plasticised self-cross-linking vinyl acetate, self-cross-linking styrene/butadiene copolymers, copolymers of vinyl chloride, vinylidene dichloride, or ethylene, and other self-cross-linking copolymers of vinyl acetate. These binders each have substantial wet strength.

The binder is preferably distributed uniformly throughout the fabric, i.e. continuously or in regularly spaced areas (e.g. in a pattern of equally spaced helically parallel lines, there being 13 lines/inch measured along a line normal to the direction of any one line). The amount of binder in the binder composition is generally from 10 to 30 per cent by weight of the fabric.

The range of strengths, weights per unit area, drape, handle, wettability and permeability of the nonwoven fabrics for use in the invention, e.g. as nappy liners, will be familiar to those skilled in the art. In general such fabrics should be soft, at least as soft as the unimpregnated fabric, should have good wet strength, be capable of carrying the oily impregnant and of giving it up to the skin, be disposable and be compatible with the skin. Nonwoven fabrics used in nappy liners of the invention may have a fabric weight of 12 to 50 g/m<sup>2</sup>, preferably 19 to 25 g/m<sup>2</sup>.

The oily impregnant is incorporated in the fabric, that is to say it is carried as a coating on the fibres within the fabric, and if the fibres are themselves absorbent as such, also within the fibres. The fabric may be treated by any suitable method to incorporate the oily impregnant, for example by dipping the fabric in the oil or the oil solution of wax, or by spraying, painting, or gravure printing the oil or solution onto the fabric. The treatment is applied to the fabric, not the individual fibres.

The treated fabric is worn against the skin as a nappy liner or as a facing layer of a nappy or as a liner or facing layer of a garment such as a diaper. Consequently it acquires a temperature close to that of the skin; the skin temperature may vary between quite wide limits but the result in general is that the treated fabric will when worn be at a higher temperature than when it is being stored before use. The transfer of oily impregnant from the nonwoven fabric to a surface with which it is in contact may tend to be temperature-dependent. Below skin temperatures, transfer of liquid by contact with other substrates or surfaces will then be decreased.

At skin temperatures there is transfer to the skin, rendering the latter water-repellent and thus providing a barrier against urine returning to the wet skin after it has been taken into and/or through the fabric, even under local pressure from the weight of the body. The transfer occurs if the body and the fabric are quite still, and is assisted if movement or pressure occurs. The skin acquires a superficial barrier to extraneous water, over the surface against which the fabric is worn. A substantially uniform layer is acquired on the skin even from a patterned fabric such as a fabric with a pattern of perforations. The barrier acquired is due to oily impregnant migrating from within the fabric in which it is initially held; the fabric is not a mere sheet carrying an external deposit of oil which would be transferred by mere contact. A proportion of the oily impregnant remains in the fabric, and the latter maintains its water-repellency.

The treated fabric has a slightly oily or greasy feel, although not to an unpleasant extent, and is quite different from, say, petrolum jelly smeared on a fabric. The effect on the skin after

wearing is visible, in close inspection, as a shiny appearance.

An effective amount of oily impregnant is one which will achieve the foregoing desirable effects and particularly provide the barrier referred to. We have found that the treated fabric will still act to transfer water away from the skin while transferring oil to the skin.

- 5 The choice of oily impregnant is affected by a variety of factors. The impregnant must for instance be water-repellent, non-toxic, non-sensitising, non-irritant to skin and non-odorous, capable of retention in nonwoven fabric and on skin and of rendering the substrate water-repellent, not expensive, not liable to dry out, solidify or flake off the fabric by virtue of melting point or crystalline nature, and acceptable as to feel and drape of the treated fabric. The oily impregnant of choice for the smooth feel it imparts to the fabric, is a solution in liquid medicinal white oil of a paraffinic ester wax, the oil containing 10 to 20 per cent by weight. Silicone oils also give a pleasing feel to the product, but these and the abovementioned wax solution in oil are economically unfavourable. Isopropyl fatty acid esters and mineral oil, however, give a product which is both technically effective and economically preferable.
- 10
- 15 Typical effective amounts of oily impregnant incorporated in the nonwoven fabric carrier may vary for instance from 15 to 90 per cent by weight based on the fabric weight, the optimum range for the wax solution being from 35 to 45 per cent.

Medicaments may also be incorporated in the nonwoven fabric if desired.

- One preferred oily impregnant from the standpoint of pleasant feel imparted to the fabric, is a solution of "Crodamol W" wax in liquid paraffin. The wax is a paraffinic ester wax with a maximum acid value of 1, a maximum iodine value of 2, a saponification value of 138 to 2153 and a melting point of 23 to 27°C. The preferred solution contains 12 parts by weight of the wax dissolved in 88 parts by weight of the oil.
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A nappy liner in accordance with the invention will now be described by way of example.

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- EXAMPLE**

- A fibrous web comprising 16.8 g/m<sup>2</sup> of 38 mm staple length, 1.5 denier viscose rayon fibres was produced from carding engines. It was then rearranged or bundled by streams of water using the equipment and process as described in Specification No. 836,397 which produces a foraminous, reticular or perforated structure in the nonwoven fabric. The bundled web was dewatered to a controlled extent by passage over a suction slot and was then printed by means of a rotogravure roller with a self-cross-linking poly(vinyl acetate/acrylate) copolymer binder containing a wax emulsion as water-repellent agent, the amount of binder and wax (dry weight) being 4.7 g/m<sup>2</sup> of the dry nonwoven fabric. The rotogravure roller employed was engraved with a pattern of equally spaced helically parallel lines, there being 13 lines per inch measured along a line normal to the direction of any one line, to ensure that the maximum area of the fabric was treated with the wax.
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- 35

The recipe of the combined binder and water-repellent liquor was:

40		Parts by weight	40
	National 125-2873*	6.296	
	Mystolene MK 8**	0.545	
45	2 per cent Antifoam DC525 soln*** (20 per cent emulsion in ninefold amount of water)	0.160	45
	Water	2.999	
50		<hr/> 10.000 <hr/>	50

\*National Adhesives & Resins Ltd., Braunston, Northants.

\*\*Catomance Ltd., Welwyn Garden City, Herts.

- 55 \*\*\*Dow Corning Ltd., Barry, Glamorgan.

- The wet printed, repellent containing fabric was dried over steam heated cans and wound up into a roll. There was applied to the fabric by a roller-printing method at an ink weight percentage of 40 per cent, an oil impregnant solution of 12 parts by weight "Crodamol W" wax in 88 parts by weight of liquid paraffin. The resultant fabric was subsequently cut and folded into nappy liners each of area 229 mm × 343 mm.
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The resulting nappy liners will give not only mechanical protection of an infant's skin from a wet nappy but also help to prevent nappy rash by transfer of oily impregnant to the skin. The impregnant can be readily removed from the skin by washing.

## CLAIMS

1. A flexible, porous nonwoven fabric layer or sheet to be worn against the skin of a person and serving as a carrier for one or more water repellent materials which migrate from the fabric to the skin when worn there against, to a sufficient extent to impart a degree of water repellency to the skin. 5
2. A composition for use in rendering human skin water repellent, comprising a water repellent oil carried by the fibres of a flexible, porous bonded nonwoven fabric layer or sheet in an amount effective to impart water repellency by migratory transfer of a proportion of the oil to skin against which the fabric is worn as a liner or inner facing for a nappy or garment.
- 10 3. A composition according to Claim 2 wherein the water repellent oil comprises a liquid medicinal white oil, a silicone oil, or an isopropyl fatty acid ester. 10
4. A composition according to Claim 2 or 3 wherein the nonwoven fabric fibres are, or have been rendered, water repellent before contact with said oil.
5. A composition according to Claim 2, 3 or 4, wherein the nonwoven fabric is a disposable nappy liner. 15
6. A composition according to Claim 5 wherein the fabric is bonded by a water repellent binder.
7. A composition according to Claim 2, 4, 5 or 6 wherein the water repellent oil is a solution in liquid medicinal white oil of a paraffinic ester wax, the oil containing 10 to 20 per cent wax by weight. 20
8. A composition according to any of Claims 2 to 7 containing from 15 to 90 per cent by weight of the water repellent oil based on the fabric weight.
9. A composition according to Claim 7 containing from 35 to 45 per cent by weight of the solution based on the fabric weight.
- 25 10. A composition according to Claim 7 or 9 wherein the paraffinic ester wax has a maximum acid value of 1, a maximum iodine value of 2, a saponification value of 138 to 153 and a melting point of 23 to 27°C. 25
11. Nappy liners substantially described in the foregoing Example.

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